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ABSTRACT

Primary students solve "oversized" story problems using drawings, equations, and written responses, helping them understand the links between the language of story problems and the numerical representations of matching equations. The activity also includes oral language and reflective writing, thus bringing together a variety of language experiences into mathematics work. During one 30-minute and one 60-minute session, students will: participate in a shared problem-solving activity; collaborate in small groups to develop a problem-solving strategy; use drawings, words, and equations to model solutions to story problems; effectively and clearly explain their problem-solving strategies to other students; and write about and reflect on their problem-solving strategies. The instructional plan, lists of resources, student assessment/reflection activities, and a list of National Council of Teachers of English/International Reading Association (NCTE/IRA) Standards addressed in the lesson are included. A sheet of sample story problems is attached. (PM)

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Giant Story Problems: Reading Comprehension through Math Problem Solving

ED 481 423

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Grade Band

K-2

Estimated Lesson Time

One 30-minute & one 60-minute session

Overview

This activity focuses on reading comprehension skills as they apply to mathematics story problems, as well as on written and verbal mathematics communication skills. Students use drawings, equations, and written responses to solve single story problems with enlarged print. The end product of this activity is a series of poster-size story problems that can serve as models for later problem-solving work.

From Theory to Practice

David and Phyllis Whitin talk about the value of writing in the mathematics curriculum in chapter one of *Math Is Language Too: Talking and Writing in the Mathematics Classroom*. They state that mathematics and language are both "ways for learners to make sense of their world" and that "writing and talking are ways that learners can make their mathematical thinking visible." One of the most concrete examples of mathematics as language is in the reading and solving of story problems.

Story problems depend on reading comprehension skills for the development of successful problem-solving strategies. Having students collaborate on story problems gives them the opportunity to learn by talking, collaborating, and sharing ideas as they compare pictures, words, and numeric symbols for consistency. *The Principles and Standards for School Mathematics*, by The National Council of Teachers of Mathematics, includes communication as a mathematics tool for all levels of learners and suggests collaboration as especially beneficial for young learners.

Whitin Phyllis, and David J. Whitin. 2000. *Math is Language Too: Talking and Writing in the Mathematics Classroom*. National Council of Teachers of English and National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics. 2000. Principles and Standards for School Mathematics. http://standards.nctm.org/.

Student Objectives

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Students will

- participate in a shared problem-solving activity.
- collaborate in small groups to develop a problem-solving strategy.
- use drawings, words, and equations to model solutions to story problems.
- effectively and clearly explain their problem-solving strategies to other students.
- write about and reflect on their problem-solving strategies.

Resources

- Sample Giant Story Problems
- "Giant Story Problems" Web Site
- Teach R Kids Web Site
- FunBrain Web Site

Instructional Plan

Resources

General classroom supplies (chart paper, colored markers, white construction paper, glue, crayons, and pencils)

Preparation

1. Prepare several appropriate story problems beforehand, either by using a large word-processing font or by writing them by hand. Story Problems should be on individual pieces of paper so that each group will receive only one story problem, and so that each group receives a different problem. More story problems can be written by the teacher, photocopied and enlarged from workbooks, or obtained at Web sites such as Teach R Kids.
2. Prepare heterogeneous groups, balanced with student strengths according to problem-solving, drawing, and writing skills.

Instruction and Activities

Session One

1. Post chart paper on the wall and gather students together near it. Inform them that they will work together to solve a math story, and that later they'll work in groups to solve their own.
2. Start with a completely blank chart paper so that students can see the entire process.
3. On the top left corner glue one story problem. Ask for a volunteer to read the problem aloud, or read it to the group. Ask for students to identify the most important information in the story. To do this, ask the following questions:
    - What is this story problem about?
    - How many [subjects/objects] are there to begin with?
    - What is happening to these [subjects/objects]?

4. As students identify the information, highlight or underline the information that will be needed to solve the problem.

5. When important words and numbers have been highlighted, work through the story problem item by item to create a drawing that models the story. Have students volunteer to do the drawings on the chart paper. All pertinent information should be illustrated. For example, in a story problem about three people who have four cookies each, the drawing would show three people, each with four cookies. Any details will be up to the students doing the drawing.

6. When the drawing is finished, review with students the language of the story problem and compare it to the drawing, checking for accuracy: "Does this picture show what it says in the story?" Ask for an equation or number sentence that will show what the drawing says and which will solve the problem. If a student suggests an incorrect equation, write it on the board (not on the chart paper) and ask students to tell why it will or will not work. When a student states a correct equation, compare it with the drawing, then have him or her write it under the drawing with a marker after other students agree that the equation will work.

7. Ask students to find the actual question in the story problem that needs to be answered: "What does this story want to know?" Read it aloud. Ask for a complete sentence that answers the question. When a sentence has been agreed upon that includes specific information (e.g., the subject's name, the numbers involved, the items' names, etc.), have a student write the sentence under the equation, using conventional capitalization and punctuation, and writing all numbers as words (i.e., instead of writing "20" a student would write "twenty") to facilitate correct spelling of number words.

8. Review all parts of the chart, and leave it posted for Session Two. Samples of student work can be found at "Giant Story Problems."

Session Two

1. Gather students together to review the Giant Story Problem chart from Session One. Have students review each part of the problem-solving process. Ask them to review the step-by-step process and list the directions on the board:

    - glue problem on paper
    - read story problem
    - underline important words
    - draw
    - write equation
    - write sentence

2. Have students get into groups. Each group will need one sheet of white construction paper (12x18), crayons, writing materials, and one story problem. (Every group should have a different problem.) If desired, assign each group a leader whose job it would be to make sure everyone in the group is participating.

3. While students work to solve their story problems, circulate among the groups to ask questions and make sure everyone is participating in the process. If students are having difficulty, try to ask leading questions rather than give them specific help with a strategy. If it appears that students are using an inappropriate strategy, help them refer back to the language of the story problem. As they work, let them know that they will be sharing their work with the class.

4. When all groups are finished, have students share their posters with the whole class, explaining their drawing by referring to their story problem, and telling why their mathematical solution will work to solve the problem.

5. To conclude the activity, have students respond on paper or in Math Journals to each of the

following questions:

- How did drawing a picture help you solve the story problem?
- What was the most interesting thing about this lesson?

6. Display all the "Giant Story Problems" on the wall.

Variations and Extensions

1. Have students meet in groups to write their own story problems, then have the groups exchange problems to solve.
2. Have students practice spelling number words at FunBrain.
3. Prepare additional "giant" story problems to keep in a basket for students to work on at a math center or during choice time.
4. Photocopy "regular-sized" story problems from workbooks, cut them up individually, and put them in a basket for students to choose from. These can be used by individual students using the same procedure as "giant" story problems, but on regular-sized paper.

Web Resources

"Giant Story Problems"
http://www.share2learn.com/wlmathgoularte1.html
Samples of student work on "Giant Story Problems"

FunBrain
http://www3.funbrain.com/numwords/index.html
Has spelling games with number words, categorized by difficulty.

Teach R Kids
http://www.teachrkids.com/fronts/curr-2.htm
Has sets of word problems, categorized by skill and level. Is not interactive.

Student Assessment/Reflections

1. Teacher observation of whole group participation.
2. Teacher observation of small group participation.
3. Student explanations of their strategies.
4. Quality of student group work.
5. Quality of individual student foilow-up work, including clarity of ideas and details in written work.

NCTE/IRA Standards

1 - Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.

3 - Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

10 - Students whose first language is not English make use of their first language to develop competency in the English language arts and to develop understanding of content across the curriculum.

12 - Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

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Sample Giant Story Problems

Five teachers were sitting at a table. Four more teachers came to sit with them. How many teachers were at the table?
A student had ten crayons. Two of them were broken. How many were not broken?
Six children were reading in the library. Each child had three books. How many books did they have all together?
There were twenty cookies on a plate. Four people decided to share them. How many cookies will each person get?

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